

A REVISION OF NEOTROPICAL *DITRICHOPHORA* CRESSON
(DIPTERA: EPHYDRIDAE)

WAYNE N. MATHIS

Department of Entomology, NHB 169, Smithsonian Institution, Washington, DC 20560,
U.S.A.

Abstract.—Neotropical species of *Ditrichophora* Cresson are reported for the first time from that region and are revised. Two new species are described and illustrated: *D. bella* (Dominican Republic. Monseñor Nouel: near Jima (19°01.2'N, 70°28.8'W; 670 m) and *D. chiapas* (Mexico. Chiapas: El Triunfo (49 km S Jaltenango)). A diagnosis of the tribe Discocerinini and an annotated key to New World genera are also provided.

Key Words: Diptera, Ephydridae, shore flies, *Ditrichophora*, New World tropics

Recent field work on the Dominican Republic and Jamaica resulted in the discovery of an undescribed species of *Ditrichophora* Cresson, a genus that has not been reported from the neotropics (Wirth 1968, Mathis and Zatwarnicki 1995). The purpose of this paper is to describe this species, which is apparently widespread in Central America and on islands of the West Indies, and a second Neotropical species that was recently found in southern Mexico. I am describing both species within the context of a revision, including an annotated key to the New World genera of Discocerinini and a revised description of the tribe and genus.

Ditrichophora was described in 1924 (Cresson 1924:159) for "Discocerine species having only two facial bristles. . ." and that are ". . . shining and in many respects resemble those of the Psilopini." The genus has remained in the tribe Discocerinini (subfamily Gymnomyzinae) since then even though the tribe has been recharacterized and now includes only those genera that are closely related to *Discocerina* Macquart (Mathis and Zuyin 1989, Mathis and Zatwarnicki 1995). Other genera that had been included in the tribe, such as *Paratissa*

Coquillett and *Rhysophora* Cresson, are now in the tribe Discomyzini (subfamily Discomyzinae).

Within Discocerinini, *Ditrichophora* is closely related and very similar to *Gymnoclasiopa* Hendel. Both genera represent basal lineages with *Gymnoclasiopa* being the sister lineage to the remaining genera of the tribe (Zatwarnicki, personal communication). For many decades, *Gymnoclasiopa* was treated as a subgenus within *Ditrichophora* (Cresson 1942, Wirth 1965). Only recently (Zatwarnicki 1992 and personal communication), with evidence that *Gymnoclasiopa* is the most basal lineage in the tribe, was it recognized as a distinct genus from *Ditrichophora*. In this paper, the concept and characterization of *Ditrichophora* excludes *Gymnoclasiopa*, and the latter is considered a distinct genus in the key to genera.

Species of *Ditrichophora* occur throughout the Old World, but until the discovery of the two species being described here, the genus was known only from the Nearctic Region in the New World. Worldwide, there are approximately 39 species (Mathis and Zatwarnicki 1995). Most species occur in

temperate, freshwater environments, especially in the northern hemisphere.

METHODS

The terminology and methods used in this study were explained previously (Mathis 1990). Because of the small size of specimens, study and illustration of the male terminalia required the use of a compound microscope. To better assure effective communication about structures of the male terminalia, I have adopted the terminology of other workers in Ephydriidae (see references in Mathis 1986). Usage of these terms, however, should not be taken as an endorsement of them from a theoretical or morphological view over alternatives that have been proposed (Griffiths 1972, McAlpine 1981). Rather, I am deferring to tradition until the morphological issues are better resolved.

Three ratios (one cephalic, two venational) are used commonly in the descriptions and are defined here for the convenience of the user (ratios are ranges based on three specimens).

1. Gena-to-eye ratio is the genal height measured at the maximum eye height divided by the eye height.
2. Costal vein ratio: the straight line distance between the apices of veins R_{2+3} and R_{4+5} /distance between the apices of veins R_1 and R_{2+3} .
3. M vein ratio: the straight line distance along M between crossveins dm-cu and r-m/distance apicad of crossvein dm-cu.

The specimens used in this study are primarily in the National Museum of Natural History (USNM), Smithsonian Institution. Paratypes of the Mexican species will be deposited in the Universidad Nacional Autónoma de México (UNAM).

Tribe Discocerinini Cresson

Discocerinini Cresson, 1925:228. Type genus: *Discocerina* Macquart, 1835.—Mathis and Zuyin, 1989:435 [diagnosis

of tribe].—Mathis and Zatwarnicki, 1995:163–186 [world catalog].

Diagnosis.—A tribe of the subfamily Gymnomyzinae that is distinguished from other tribes by the following combination of characters:

Head: Frontal vitta (or ocellar triangle) mostly bare of setulae, not conspicuously setulose; ocellar setae well developed, inserted anterolaterad of anterior ocellus; reclinate fronto-orbital seta inserted anteromedial of proclinate fronto-orbital (if 2 proclinate fronto-orbitals present, reclinate seta inserted anteromedial of the larger, posterior, proclinate seta); pseudopostocellar setae well developed, proclinate, and slightly divergent, usually at least half length of ocellar setae. Pedicel bearing a large seta anterodorsally; arista bearing 4–6 dorsal rays, inserted along length of arista. Face generally shallowly arched, frequently more prominent at level of dorsal facial setae, not conspicuously pitted, rugose, tuberculate, or carinate. Gena generally short (secondarily high in some species), bearing setulae (including midportion) and 1 large seta, its posterior (postgenal) margin rounded, not sharp. Oral opening and clypeus narrow; mouthparts generally dark colored.

Thorax: Mesonotum generally microtomentose, frequently densely so, although variable; dorsocentral setae weakly developed, only posteriormost pair conspicuous; acrostichal setulae in 2–4 rows, frequently with a prescutellar pair better developed; postsutural supra-alar seta usually evident although sometimes reduced or absent; prescutellar acrostichal setae inserted approximate and behind alignment of posteriormost dorsocentral setae; scutellar disc usually densely setulose; scutellum bearing 2 large, marginal setae; notopleural setae 2, inserted at same level near ventral margin; anepisternum with 2 subequal setae inserted along posterior margin. Wing with vein R_{2+3} long, extended nearly to level of apex

of vein R₄₊₅. Foreleg normally developed, not raptorial with greatly enlarged femur.

Abdomen: Male terminalia: Cerci paired, hemispherical, setose, bearing sides of rectum; epandrium U-shaped, encircling cerci, anterior margin rounded, in lateral view with setae mainly on dorsum and along anteroventral margin; dististyli lacking or fused indistinguishably with epandrium; posterolateral arms of epandrium attached with ventral apex of gonites, middle of posterior margin a base for aedeagal apodeme; aedeagal apodeme situated under aedeagus, associated with hypandrium and with ventral part of base of aedeagus, ventral margin with lobate appendix providing attachment for genital muscles that move aedeagus; gonite paired, connecting sides of base of aedeagus and laterodorsal margin of epandrium, bearing 1 or some setulae; aedeagus tubular, tapered anteriorly; ejaculatory apodeme as a spatula against background of ductus ejaculatorius.

Discussion.—In our classification for the family Ephydriidae (Mathis and Zatwarnicki 1995), the subfamily Gymnomyzinae Latreille comprises six tribes, including Discocerinini. The latter is the most speciose of the tribes, with 144 of the 346 species presently included in Gymnomyzinae. There are eight genera in Discocerinini, and all eight occur in the New World and are included in the annotated key that follows.

ANNOTATED KEY TO NEW WORLD GENERA AND SUBGENERA OF DISCOCERININI

- 1. Face with secondary series of dorsolaterally inclined setae laterad to primary series *Polytrichophora* Cresson [18 species worldwide; 7 New World species, presently being revised (Mathis, in preparation)]
- Face with secondary series of setae lacking or suggested only by medially inclined setulae 2
- 2. Notopleuron bare of setulae 3
- Notopleuron setulose in addition to 2 large setae 7
- 3. Forefemur slightly enlarged, bearing distinct row of stout, short setae along apical half of posteroventral surface *Pectinifer* Cresson

- [Monotypic; *P. aeneus* (Cresson), New World tropics]
- Forefemur normally developed, lacking row of short, stout setae along posteroventral surface 4
- 4. Postsutural supra-alar seta strong, distinct, longer than posterior notopleural seta. Face with upcurved seta at lower lateral extremity *Diclasiope* Hendel [5 species worldwide; a single New World species, *D. lacteipennis* (Loew)]
- Postsutural supra-alar seta very short or absent, if distinguishable distinctly shorter than posterior notopleural seta. Face without upcurved seta at lower lateral extremity 5
- 5. Hind tibia with a preapical, ventral, spurlike seta; facial series comprising 2–3 large setae, dorsal seta inserted slightly medially from other setae and arising from distinct, shiny papilla, with a small, slightly dorsoclinate seta laterad of dorsal seta; generally microtomentose, cinereous species, appearing dull *Hecamedoides* Hendel [23 species worldwide; a single New World species, *H. unispinosus* (Collin)]
- Hind tibia lacking a preapical, ventral spurlike seta; facial series comprised of 2 large setae, dorsal seta not arising from a shiny papilla and lacking a smaller seta laterad of dorsal seta; mostly bare to sparsely microtomentose, shiny to subshiny species 6
- 6. Face rather flattened, antennal grooves not always sharply defined ventrally; facial series of setae inserted very close to parafacials, dorsal-most seta not appreciably more removed mesad than ventral seta *Gymnoclasiope* Hendel [25 species worldwide; 8 Nearctic species]
- Face rather prominent at level of dorsal facial setae, sometimes transversely carinate; antennal grooves generally sharply defined ventrally *Ditrichophora* Cresson [39 species worldwide; 7 Nearctic species, 2 Neotropical species]
- 7. Gena and lower part of parafacial broad; lateral margin of abdomen usually with gray to whitish microtomentose areas, these usually wedge shaped *Hydrochasma* Hendel [6 species worldwide, all in the New World]
- Gena and parafacial rather narrow; abdomen lacking wedge-shaped, light-colored areas laterally (genus *Discocerina* Macquart) 8 [28 species worldwide in 3 subgenera]
- 8. Parafacial bearing setulae subgenus *Discocerina* Macquart [9 species worldwide; 7 New World species]
- Parafacial lacking setulae 9
- 9. Facial series of setae 2, these well separated, distance between subequal to length of 1st fla-

gellomere: parafacial very narrow at antero-ventral margin of eye; postsutural supra-alar and prescutellar acrostichal setae greatly reduced or lacking subgenus *Basila* Cresson [8 species worldwide, all in the New World]
 - Facial series of setae 3-4, distance between setae conspicuously less than length of 1st flagellomere; parafacial evenly evident throughout length; postsutural supra-alar and prescutellar acrostichal setae present
 subgenus *Lamproclasiopa* Hendel [11 species worldwide; 9 New World species]

Genus *Ditrichophora* Cresson

Ditrichophora Cresson, 1924:159. Type species: *Ditrichophora exigua* Cresson, 1924, original designation.—Mathis and Zatwarnicki, 1995:169-174 [world catalog].

Strandiscocera Duda, 1942:15. Type species: *Discocerina nigrithorax* Becker, 1926, original designation.—Papp, 1979: 100 [synonymy].

Diagnosis.—Small to medium-sized shore flies, length 1.25-3.10 mm; generally mostly bare to sparsely microtomentose, shiny to subshiny species.

Head: Face rather prominent at level of dorsal facial seta, sometimes transversely carinate; antennal grooves generally sharply defined ventrally; face lacking secondary series of setae; facial setae usually 2-3, dorsal seta not arising from shiny papilla, lacking an upcurved seta at lower lateral extremity; parafacial narrow throughout length, lacking setulae; gena generally low. Eye generally oval, moderately conspicuously microsetulose, bearing several interfacetal setulae.

Thorax: Postpronotal and presutural supra-alar setae well developed; postsutural supra-alar seta reduced or lacking; notopleuron bare of setulae but bearing 2 larger setae; anterior notopleural seta inserted closer to posterior notopleural seta than to postpronotal seta. Forefemur normally developed, lacking row of short, stout setae along posteroventral surface; hindtibia lacking a preapical, ventral, spurlike seta.

Abdomen: Abdomen usually unicolor-

ous, lacking wedge shaped, light colored areas laterally. Fourth tergum of ♂ only slightly longer than 3rd. Male terminalia as follows: epandrium complete dorsally, although sometimes attenuated, usually wider ventrally, especially in lateral view; cercus hemispherical or elongate (3× as long as wide), more narrowly pointed dorsally, not fused anteriorly with epandrium; aedeagus either simple, mostly tubular, in lateral view cigar shaped, ovate, or tapered toward apex or bifurcate apically (best seen in lateral view) with both lobes large; aedeagal apodeme situated behind aedeagus, curved, keel variously shaped; gonite variously shaped but generally pointed apically, bearing a subapical or apical setula; ejaculatory apodeme present, L-shaped; hypandrium turned up anteriorly, in lateral view irregularly curved.

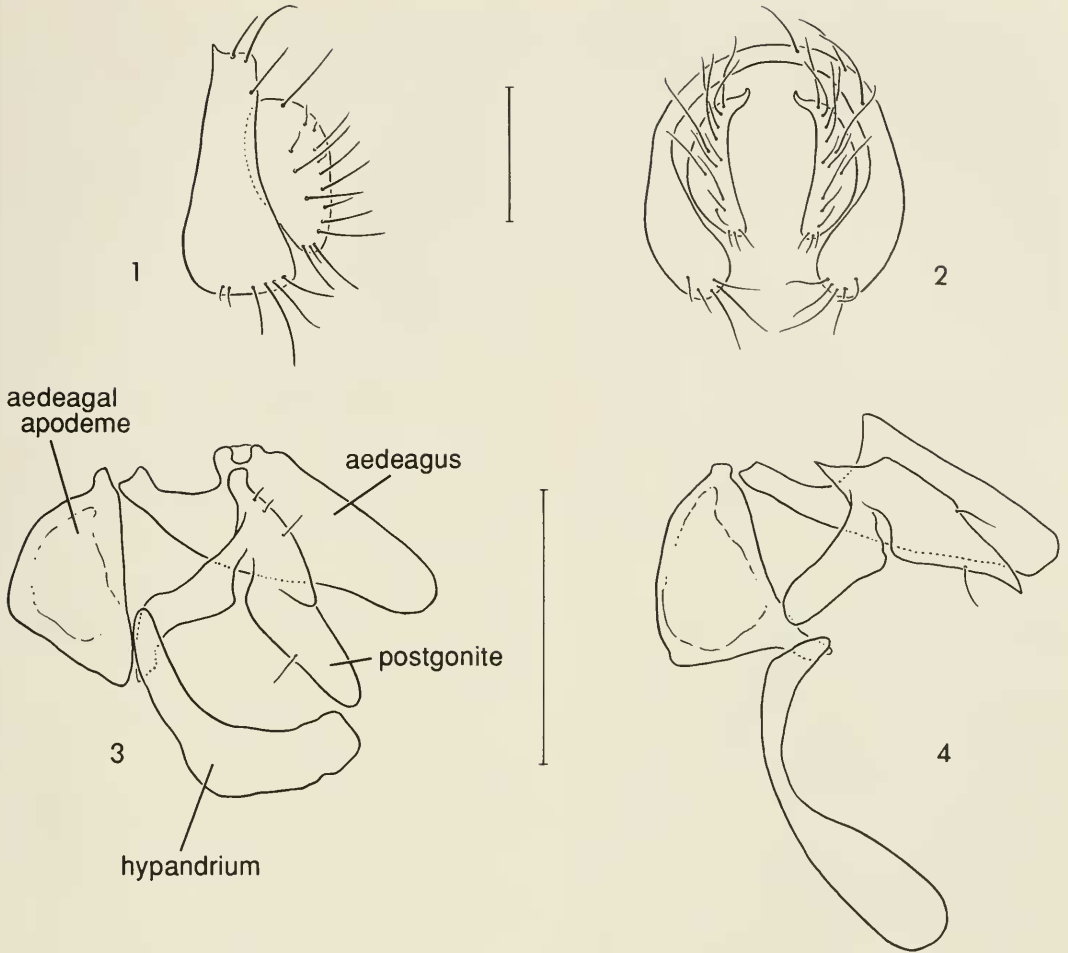
Discussion.—The two Neotropical species described below are apparently closely related, both having small, crescent-shaped indentations on each side of the anterior portion of the frons above the antennal bases. Moreover, the structures of the male terminalia, especially the external male terminalia (epandrium and cerci), are very similar.

KEY TO NEOTROPICAL SPECIES OF *DITRICHOPHORA*

1. Postpronotum and notopleuron of male generally bare of microtomentum, shiny, similar to mesonotum and anepisternum; prescutellar acrostichal setae well developed; male with anterior third of frons bare of microtomentum, shiny black *D. chiapas*, new species
- Postpronotum and most of notopleuron of male densely invested with fine, brown microtomentum, contrasted sharply with generally shiny, adjacent mesonotum and anepisternum; prescutellar acrostichal setae weakly developed; frons of male generally sparsely microtomentose to anterior margin . . . *D. bella*, new species

Ditrichophora bella Mathis, NEW SPECIES (Figs. 1-3)

Description.—Small to medium-sized shore flies, length 1.90-3.10 mm; generally shiny black.



Figs. 1-4. 1-3; *Ditrichophora bella*. 1. External male terminalia (epandrium and surstyli), lateral view. 2. Same, posterior view. 3. Internal male terminalia (postgonite, pregonite, hypandrium, aedeagal apodeme, aedeagus), lateral view. 4. *Ditrichophora chiapas*. Internal male terminalia (postgonite, pregonite, hypandrium, aedeagal apodeme, aedeagus), lateral view. Scale = 0.1 mm.

Head: Frons of male generally moderately microtomentose to anterior margin, only small, linear patch anterolaterally and at base of setae bare of microtomentum; frons of female with small bare areas anteriorly; 1 proclinate, fronto-orbital seta, inserted just behind and laterad of reclinate seta. Antenna black; apical margin of pedicel and 1st flagellomere invested with whitish gray microtomentum; arista bearing 5 dorsal rays. Face bearing 2 lateral, facial setae, dorsal seta inserted at level of facial prominence, ventral seta inserted toward ventral margin, distance between facial se-

tae about equal to length of 1st flagellomere; face black but mostly invested with silvery white microtomentum, only ventral portion of antennal grooves, vertical stripe immediately adjacent to parafacial, and median stripe that curves laterally ventrally bare, shiny, black; parafacial completely microtomentose, whitish gray. Gena-to-eye ratio 0.1-0.13. Mouthparts, including maxillary palpus, black.

Thorax: Mesonotum generally sparsely microtomentose, golden brown, becoming sparser to bare laterally, through supra-alar area, thereafter laterally sparsely microto-

mentose, male bearing a very distinctive stripe of dense, fine, brown microtomentum extended from postpronotum through most of notopleuron, female shiny black, similar to adjacent areas; prescutellar acrostichal setae weakly developed. Wing hyaline; costal ratio 0.37–0.44; M vein ratio 0.60–0.63. Legs except tarsi black, mostly shiny, femora with some surfaces very sparsely microtomentose; tarsi yellow except apical 2 brown; forefemur unadorned with short, peglike setulae along posteroventral surface. Halter white.

Abdomen: Black, generally shiny, especially laterally and ventrally. Male terminalia (Figs. 1–3): Epandrium broadly rounded dorsally in posterior view (Fig. 2), narrowed dorsally, becoming wider ventrally, ventral margin bluntly rounded in lateral view (Fig. 1); cerci lunate in posterior view (Fig. 2); aedeagus in lateral view slipper-like, with toe or apex comparatively narrowly rounded (Fig. 3); aedeagal apodeme more or less triangular in lateral view; postgonite and pregonite fused basally; postgonite with 2–3 setulae along basoposterior margin and 1 setula along margin toward hypandrium, apex narrowly rounded in lateral view (Fig. 3); hypandrium broadly rounded along anterior margin, angularly notched medially with 2 arms attached to aedeagal apodeme.

Type material.—The holotype ♂ is labeled “DOMINICAN RP. Monsñ. Nouel: nr. Jima, 670 m, 19°01.2'N, 70°28.8'W[,] 10 May 1995, W. N. Mathis/HOLOTYPE *Ditrichophora bella* ♂ W. N. Mathis USNM [red; species name and gender handwritten].” The holotype is double mounted (minuten in block of plastic), is in excellent condition, and is in the USNM. The allotype and 24 paratypes (14 ♂, 10 ♀; USNM) bear the same locality label as the holotype. Other paratypes are as follows: JAMAICA. *St. Andrew*: Hardwar Gap (18°04.2'N, 76°44'W), 17 May 1996, D. and W. N. Mathis, H. Williams (1 ♂, 1 ♀; USNM). MEXICO. *Chiapas*: El Triunfo (49 km S

Jaltenango; 1800 m), 14 May 1985, W. N. Mathis (1 ♂; USNM).

Distribution.—Neotropical: Mexico (CHI), West Indies (Dominican Republic, Jamaica).

Diagnosis.—This species is distinguished from congeners, especially *D. chiapas*, by the following combination of characters: Postpronotum and most of notopleuron of male densely invested with fine, brown microtomentum, contrasted sharply with generally shiny, adjacent mesonotum and anepisternum; prescutellar acrostichal setae weakly developed; frons of male generally sparsely microtomentose to anterior margin; halter white; only 1 proclinate fronto-orbital seta; and pattern of silvery white microtomentum on face (see species description).

Etymology.—The species epithet, *bella*, meaning “pretty, lovely, fine,” is of Latin derivation and refers to the external attributes of this species.

Remarks.—All specimens were collected in montane habitats that were frequently overcast if not enshrouded in a foggy mist. The specimens from the Dominican Republic were mostly collected from a pile of spoiling cabbage that had been discarded on the roadside.

This species is sexually dimorphic, with the male have the stripe of dense but fine microtomentum extended from the postpronotum to the posterior margin of the notopleuron. Females are shiny black throughout this area of the pleuron, similar to portions of the mesothorax that are immediately adjacent.

Ditrichophora chiapas Mathis,

NEW SPECIES

(Fig. 4)

Description.—Moderately small shore flies, length 2.0–2.65 mm; generally shiny black.

Head: Frons of male and female similar, moderately microtomentose on posterior portion, although bare at bases of setulae and small area just laterad of posterior ocelli, anterior third of frons bare, shiny, with

2 lunate indentations, median area with pointed extension of moderately microtomentum from posterior portion; 1 proclinate, fronto-orbital seta, inserted just behind and laterad of reclinate seta. Antenna black; apical margin of pedicel and 1st flagellomere invested with whitish gray microtomentum; arista bearing 5 dorsal rays. Face bearing 3 lateral, facial setae, dorsal seta longest, inserted at level of facial prominence, ventral setae progressively shorter, evenly spaced with distance between less than width of 1st flagellomere; face mostly black, shiny, but with pattern of silvery white microtomentose, vertical stripes; lateral facial stripe immediately adjacent to parafacial, other vertical stripe just laterad of midfacial vertical bare area; also silvery white microtomentose on dorsal portion of antennal grooves and along ventral, facial margin; parafacial bare, shiny black. Genito-eye ratio 0.1–0.12. Mouthparts, including maxillary palpus, black.

Thorax: Mesonotum generally sparsely microtomentose, golden brown, becoming bare laterally through supra-alar area and continuing ventral through pleural area; prescutellar acrostichal setae well developed. Wing hyaline; costal ratio 0.40–0.43; M vein ratio 0.70–0.73. Legs except tarsi black, mostly shiny, femora with some surfaces very sparsely microtomentose; tarsi yellow except apical 1–2 brown; forefemur with row of numerous, very short, peglike setulae along posteroventral surface. Halter white.

Abdomen: Black, generally shiny, especially laterally and ventrally. Male terminalia (Fig. 4): Epandrium and cerci as in *D. bella*; aedeagus in lateral view slipper-like, with toe or apex comparatively bluntly rounded (Fig. 4); aedeagal apodeme more or less triangular in lateral view (Fig. 4); postgonite and pregonite fused basally; postgonite with 1 setula along basoposterior margin and 1 setula along margin toward hypandrium, apex acutely rounded in lateral view (Fig. 4); hypandrium broadly rounded along anterior margin, angularly notched

medially with 2 arms attached to aedeagal apodeme.

Type material.—The holotype ♂ is labeled "MEXICO. Chiapas: El Triunfo (49 km S Jaltenango) 14 May 1985, 1800 m[,] Wayne N. Mathis/HOLOTYPE *Ditrichophora chiapas* W. N. Mathis USNM [red; species name handwritten]." The holotype is double mounted (minuten in block of plastic), is in excellent condition, and is in the USNM. The allotype ♀ and four paratypes (4 ♂; USNM) bear the same locality label as the holotype. Other paratypes are as follows: MEXICO. Chiapas: El Triunfo (49 km S Jaltenango; 1300–2000 m), 13–15 May 1985, W. N. Mathis (3 ♂; UNAM, USNM).

Distribution.—Neotropical: Mexico (CHI).

Diagnosis.—This species is distinguished from congeners, especially *D. bella*, by the following combination of characters: Postpronotum and notopleuron of male generally bare of microtomentum, shiny, similar to mesonotum and anepisternum; prescutellar acrostichal setae well developed; male with anterior third of frons bare of microtomentum, shiny black; halter white; only 1 proclinate fronto-orbital seta; and pattern of silvery white microtomentum on face (see species description).

Etymology.—The species epithet, *chiapas*, refers to the Mexican state where the type series was collected and is treated as a noun in apposition.

Remarks.—El Triunfo is a site in the cloud forest of southern Mexico (some of the only cloud forest that remains largely undisturbed in Mexico).

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LITERATURE CITED

- Cresson, E. T., Jr. 1924. Descriptions of new genera and species of the dipterous family Ephydriidae. Paper VI. *Entomological News* 35(5): 159–164.
- . 1925. Descriptions of new genera and species of the dipterous family Ephydriidae. VII. *Entomological News* 36(6): 165–167.
- . 1942. Synopses of North American Ephydriidae (Diptera) I. The Subfamily Psilopinae, with Descriptions of New Species. *Transactions of the American Entomological Society* 68: 101–128.
- Duda, O. 1942. Neue oder ungenügend bekannte Zweiflügler der paläarktischen Region aus meiner Sammlung. 2. Fortsetzung. *Deutsche Entomologische Zeitschrift* 1–4: 1–39.
- Griffiths, G. C. D. 1972. The Phylogenetic Classification of Diptera Cyclorrhapha with Special Reference to the Structure of the Male Postabdomen. *Series Entomologica* 8: 1–340 pp. W. Junk, Hague.
- Mathis, W. N. 1986. Studies of Psilopinae (Diptera: Ephydriidae), I: A revision of the shore fly genus *Placopsidella* Kertész. *Smithsonian Contributions to Zoology* 430: 1–30.
- . 1990. A revision of the shore-fly genus *Diphua* Cresson (Diptera: Ephydriidae). *Proceedings of the Entomological Society of Washington* 92(4): 746–756.
- Mathis, W. N. and T. Zatwarnicki. 1995. A world catalog of the shore flies (Diptera: Ephydriidae). *Memoirs on Entomology, International* 4: vi + 423 pp.
- Mathis, W. N. and J. Zuyin. 1989. A review of the shore-fly genus *Polytrichophora* Cresson from Asia (Diptera: Ephydriidae). *Proceedings of the Biological Society of Washington* 102(2): 434–446.
- McAlpine, J. F. 1981. Morphology and terminology-adults, pp. 9–63. In McAlpine, J. F., et al., eds., *Manual of Nearctic Diptera*. Ottawa. [Volume 1 is Monograph 27 of Research Branch Agriculture Canada.]
- Papp, L. 1979. A contribution to the revision of the Palaearctic Ephydriidae (Diptera). *Folia Entomologica Hungarica, series nova* 32(1): 97–104.
- Wirth, W. W. 1965. Ephydriidae, pp. 734–759. In Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson, eds., *A Catalog of the Diptera North of Mexico*. Handbook, 276: 1696 pp. U.S. Department of Agriculture, Washington, D.C.
- . 1968. 77. Family Ephydriidae, pp. 1–43. In Papavero, N., ed., *A catalogue of the Diptera of the Americas south of the United States*. Departamento de Zoologia, Secretaria de Agricultura, São Paulo.
- Zatwarnicki, T. 1992. A new classification of Ephydriidae based on phylogenetic reconstruction (Diptera: Cyclorrhapha). *Genus* 3(2): 65–119.